

SERVICE MANUAL
MODEL PLUS 4 COMPUTER
Preliminary
OCT. 1984 PN-314001-04



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Commodore Business Machines, Inc.

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PLUS 4 PRODUCT SPECIFICATION

MEMORY

64K RAM. 60K RAM User accessible for BASIC programs.

ROM

32K ROM Standard (includes operating system and BASIC interpreter) with 32K additional ROM containing the built-in productivity software.

MICROPROCESSOR

7501 Microprocessor — .89 or 1.76 MHz clock.

DISPLAY

40 Columns x 25 lines of text.

COLORS

128 Colors (16 colors; 8 luminance levels).

CHARACTERS

Upper & lower case letters, numerals and symbols. Reverse and flashing characters. All PET graphic characters.

DISPLAY MODES

Text characters. High resolution graphics. Split screen text/high resolution graphics. Multicolor graphics.

RESOLUTION

320 x 200 Pixels

SOUND

2 Tone generators or 1 Tone and 1 white noise generator.

VOLUME

8 Volume levels

KEYBOARD

Full size typewriter style design

KEYS

67 Keys total. 4 Cursor control keys. 4 Programmed (reprogrammable) function keys (up to 8 user defined functions possible). Color control keys. HELP key. Upper and lower case character set. Graphics character set.

INPUTS/OUTPUTS

PLUS/4 MODEM (User) port. Serial port. ROM cartridge and parallel disk drive port. 2 Joystick ports. C1531 Cassette drive interface port. RF Output-channel 3 or 4. Video output-composite/chrominance/luminance. Audio input/output. Power supply input.

PLUS 4 PRODUCT SPECIFICATION (Continued)

FEATURES

Built-in extended BASIC 3.5 — over 75 commands. Built-in Machine Language monitor — over 12 commands. Built-in graphics and sound commands. Screen window capability. Reset button (Warm start). Built-in integrated productivity software.

PERIPHERALS

C1551 Fast Disk drive, C1531 Datasette, MPS 802 Dot matrix printer, MPS 803 Dot matrix printer, DPS 1101 Daisy wheel printer, C1802 color monitor.

OTHER PERIPHERALS

C1541 Disk drive, MPS 801 Dot matrix printer, C1702 color monitor.

PLUS 4 OVERVIEW

The Plus 4 system is based on the 7501 microprocessor, an HMOS version of the 6510. Video processing is achieved by the 7360 TED chip. 64K bytes of dynamic RAM are accomplished by 8 (64K x 1) I.C.'s. (See page). The system program is contained in 2 (16K x 8) ROMs. The system supports up to 128K x 8 of ROM banked in 16K sections. By software control, through the 7360, ROM can be completely banked out and RAM banked in for a true 64K of RAM (minus 256 byte pages), allowing 60,671 bytes available for BASIC.

Keyboard and joystick scanning are accomplished by outputting the row data on the data bus while addressing a particular register in the TED chip. This will in turn cause the TED chip to latch the column information.

A standard serial port supports serial bus peripherals such as the 1541 disk drive and the various serial printers. A cassette port is provided and the expansion port supports ROM cartridges. TTL serial ASCII is intended to drive an RS-232 adapter.

**PARTS LIST
PLUS/4**

TOP CASE ASSY

Top Case	C 251453-01
Keyboard, 67 Key, KKR-I	C 251501-01
Nameplate	C 251655-01
Shield Clip, R	C 251855-01
Shield Clip, F	C 251856-01

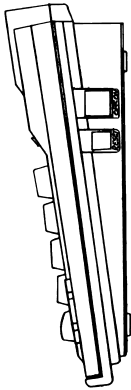
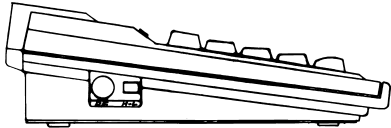
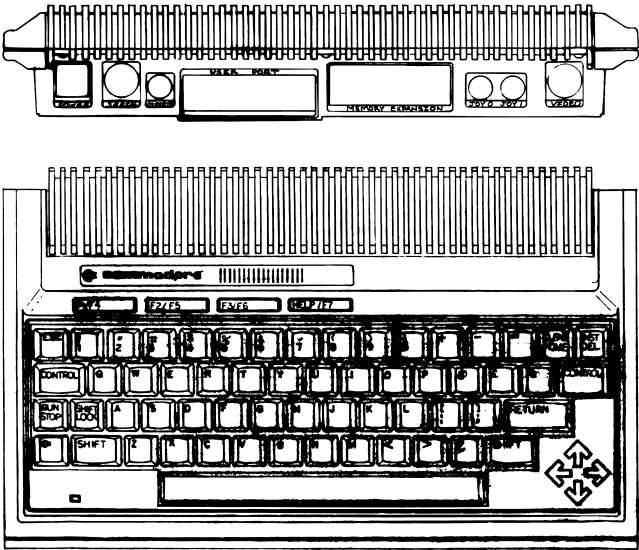
BOTTOM CASE ASSY

Bottom Case	C 251454-01
Foot, Self-Adhesive	C 950157-04
Paper Shield	C 310156-01
Shield Chip	C 310199-01
Shield Plate	C 310197-01
Insulation Sheet	C 310198-01

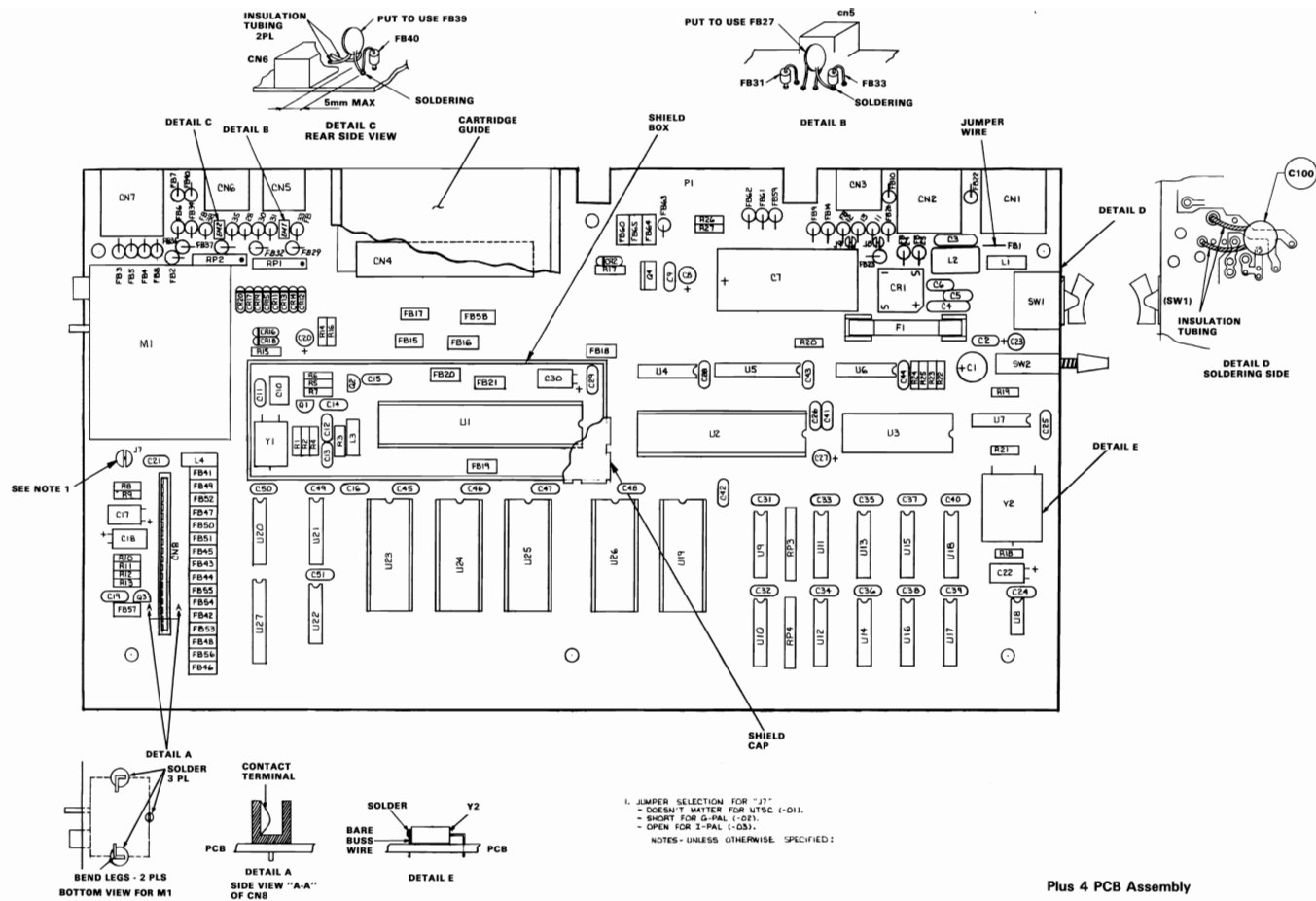
ACCESSORIES

Users Manual	C 310196-01
Power Supply	C 310157
RF Cable	C 326189-02
Switch Box	C 904778-01

C — Commodore Stock Part



Plus 4 Casework Identification



PARTS LIST — PLUS/4 PCB ASSEMBLY #310163-01

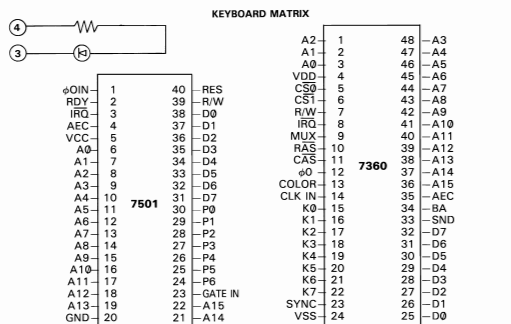
PLEASE NOTE: Commodore part numbers are provided for reference only and do not indicate the availability of parts from Commodore. Industry standard parts (Resistors, Capacitors, Connectors) should be secured locally. Approved cross-references for TTL chips, Transistors, etc. will be available in manual form through the Service Department in November of 1984. Unique or non-standard parts will be stocked by Commodore and are indicated on the parts list by a "C".

INTEGRATED CIRCUITS		DIODES (Continued)	
U1	7360 VLSI, Text Display (TED) Sub: C 251535-01 8360 C 251535-02	CR1 (cont.)	Bridge Rectifiers DBA20C Sanyo 251026-03
U2	7501 Custom Microprocessor C 251536-01	CR2	Diode, Zener RD 6.8 EB 900927-01
U3	6551A (Synertek) 901895-02	CR11-20	Diode, IN 914 Sub: 900850-16 Diode, IN 4148 Taping 251819-21 Sub: Diode, IN 4148 900850-01
U4	74LS08 901521-03	RESISTORS — All values are in ohms-1/4 W 5% unless noted otherwise.	
U5	6529B Single Port Interface C 251640-03	R1	4.7K
U6	74LS04 901521-02	R2	10K
U7	7406 901522-06	R3	470K
U8	555 901523-01	R4	220K
U9-10	74LS257 901521-57	R5	18K
U11-18	4164-2 D-RAM 901505-01	R6	1.5K
U19	7700-010 PLA C 251641-02	R7	470K
U20	74LS139 901521-18	R8	100K
U21	74LS175 901521-34	R9	1K
U22	74LS27 901521-22	R10	1K
U23	2312B ROM TED Basic C 318006-01	R11	12K
U24	23128 ROM TED Kernal C 318005-04	R12	10K
U25	23128 FUNCTION ROM, 3+1 LOW C 317053-01	R13	1K
U26	23128 FUNCTION ROM, 3+HIGH C 317054-01	R14	240
U27	6529B Single Port Interface C 251640-03	R15	250
TRANSISTORS		R16	100K
Q1-Q3	2SC 1815 902693-01	R17	1.5K
Q4	2SD 880 902694-01 Sub: Tip 29A 902653-01 Sub: 2SD 1266 902694-04	R18	47K
DIODES		R19	100K
CR1	Bridge Rectifiers S2VB10 Sindengen 215026-01 Sub: Bridge Rectifiers DBA20B Sanyo 251026-02 Sub:	R20	3K
		R21	1K
		R22	1K
		R23	1K
		R24	1K
		R25	1K
		RESISTOR PACK	
		RP1, 2	3.3K, 6 PIN 902441-29
		RP3, 4	68, 8 PIN 4 ISOLATED 326149-06
		CAPACITORS	
		C1	Elect 0.1 μ F 25V 900100-40
		C2	Ceramic 0.1 μ F 25V 251075-06
		C3	Film 0.22 μ F 100V 900150-11
		C4	Film 0.22 μ F 100V 900150-11
		C5-C6	Ceramic 0.22 μ F 50V 900022-01
		C7	Elect 2200 μ F 16V 900101-33
		C8	Elect 10 μ F 16V 900100-25
		C9	Ceramic 0.1 μ F 25V 251075-06
		C10	Trimmer 40 pF 251029-02
		C11	Ceramic 22 pF 50V 251070-14

PARTS LIST — PLUS/4
PCB ASSEMBLY # 310163-01 (Continued)

CAPACITORS (Continued)				MISCELLANEOUS (Continued)		
C12	Ceramic	220 pF 50V	Sub: 251071-26 Sub:	FB2-14	Ferrite bead	325563-01
	Ceramic	220 pF 50V	900463-08	FB15-21	Ferrite bead	903025-01
C13	Ceramic	150 pF 50V	251071-24	FB22-26, FB28-38, FB40	Ferrite bead	325563-01
	Ceramic	150 pF 50V	900462-41	FB41-58	Ferrite bead	903025-01
C14	Ceramic	0.1 μ F 25V	251075-01	FB59	Ferrite bead	325563-01
C15-C16	Ceramic	0.1 μ F 25V	251075-06	FB60	Ferrite bead	903025-01
C17-C18	Ceramic	10 μ F 16V	900100-25	FB61-63	Ferrite bead	325563-01
C19	Ceramic	0.01 μ F 25V	251075-01	FB64-65	Ferrite bead	903025-01
C20	Elect	10 μ F 16V	900100-25			
C21	Ceramic	0.1 μ F 25V	251075-06	EM1,2	EMI Filter	251842-01
C22	Elect	10 μ F 16V	900100-25			
C23	Elect	1 μ F 16V	900100-16	CN1	Connector 4 PIN (power supply)	
C24-C26	Ceramic	0.1 μ F 25V	251075-06			C 251614-01
C27	Elect	10 μ F 16V	900100-25	CN2	Connector 6 PIN DIN (serial bus)	
C28-C29	Ceramic	0.1 μ F 25V	251075-06			C 903361-01
C30	Elect	10 μ F 16V	900100-25	CN3	Connector 7 PIN MINI DIN (cassette)	
C31-C32	Ceramic	0.1 μ F 25V	251075-06			C 251616-01
C33-C40	Ceramic	0.22 μ F 25V	251075-07	CN4	Connector 50 PIN Female Edge (exoab)	
	Sub:					C 251630-01
	Ceramic	0.22 μ F 50V	900022-01	CN5-6	Connector 8 PIN MINI DIN (joy 1 & 2)	
C41-C51	Ceramic	0.1 μ F 50V	900020-06			C 251259-01
	Sub:			CN7	Connector 8 PIN DIN (audio/video)	
	Ceramic	0.1 μ F 50V	9000010-01			325573-01
C100	Ceramic	0.1 μ F 50V	900010-20	CN8	Connector 18 PIN (keyboard)	
						C 251841-01
MISCELLANEOUS						
Y1	Crystal	14.31818 MHZ	251081-01	L1	Noise Filter	251264-01
	Sub:			L2	Line Filter	906127-01
	Crystal	14.31818 MHZ	251081-02		Sub:	251701-01
Y2	Crystal	1.8432 MHZ	900555-02		Sub:	
SW1	Switch, Rocker (PC Mount)		C 251587-01	L3,L3	Coil Inductor 1.2 uHpt	901152-01
SW2	Switch, Push Button		C 251260-01		Sub:	325570-01
M1	RF Modulator		C 251844-01	F1	Fuse 250V 1.5A	903556-18
	Sub:				Fuse Clip	906102-01
	RF Modulator		251311-01		Cartridge Guide	310171-01
					Shield Box	C 310172-01
					Shield Cap	C 310173-01

C — Commodore Stock Part



**PIN ASSIGNMENT
U1-251535-01
VLSI, TEXT DISPLAY
(TED)**



M₁ SCHEMATIC ON PAGE 11

PIN CONFIGURATION			
VSS	1	28	R/W
CS0	2	27	02
CS1	3	26	IRQ
RES	4	25	D7
RXC	5	24	D6
XTL1	6	23	D5
XTL0	7	22	D4
RTS	8	21	D3
CTS	9	20	D2
TXD	10	19	D1
OTR	11	18	D0
RXD	12	17	DSR
RS0	13	16	DCD
RS1	14	15	VCC

U3-901895-02 ACIA			
SYNERTEK	SYP6551A	2 MHZ	

PIN CONFIGURATION			
FE	1	28	VCC
I7	2	27	I8
I6	3	26	I9
I5	4	25	I10
I4	5	24	I11
I3	6	23	I12
I2	7	22	I13
I1	8	21	I14
I0	9	20	I15
F7	10	19	CE
F6	11	18	F0
F5	12	17	F1
F4	13	16	F2
GND	14	15	F3

U19-251641-02 PLA			
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TRANSMIT/RECEIVE CHARACTERISTICS

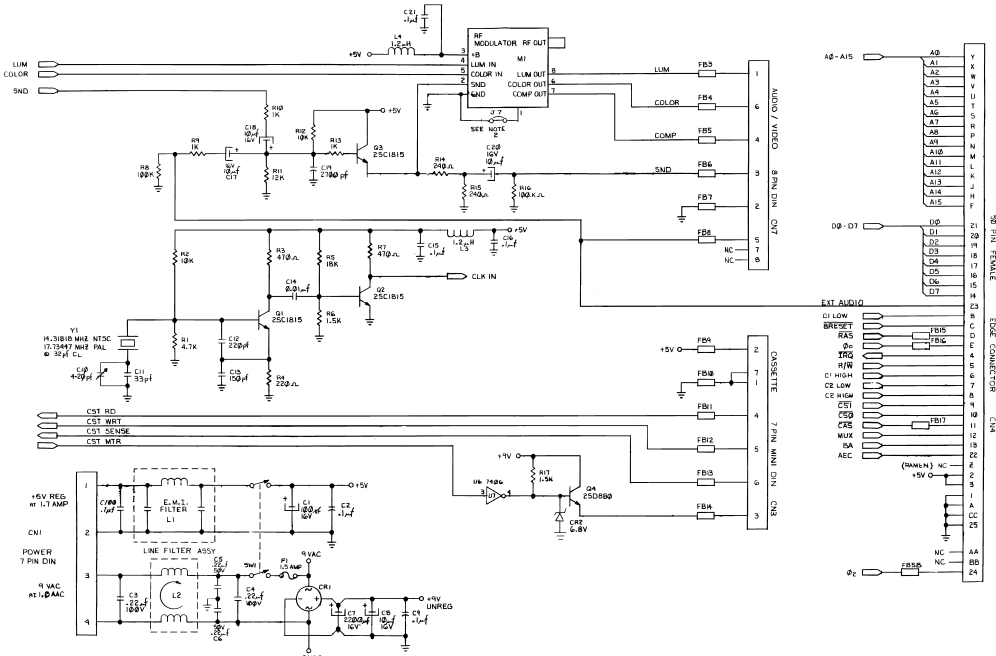
CHARACTERISTICS	SYM	-02		UNIT
		MIN	MAX	
TRANSMIT/RECEIVE CLOCK RATE	t _{CCV}	400	—	ns
TRANSMIT/RECEIVE CLOCK HIGH TIME	t _{CH}	175	—	ns
TRANSMIT/RECEIVE CLOCK LOW TIME	t _{CL}	175	—	ns
XTL1 TO TXD PROPAGATION DELAY	t _{DD}	—	500	ns
RTS PROPAGATION DELAY	t _{DLY}	—	500	ns
IRQ PROPAGATION DELAY (CLEAR)	t _{IRQ}	—	500	ns

(tr, tf = 10 to 30 ns)
*The Baud Rate with External Clocking is:
BAUD RATE = $\frac{1}{16 \times t_{CCV}}$

PIN CONFIGURATION			
CS	R/W	D0-D7	
L	L	DATA BUS TO PORT	
L	H	PORT TO DATA BUS	
H	X	ISOLATION	

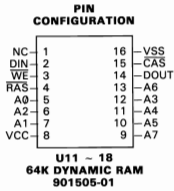
L = LOW LEVEL
H = HIGH LEVEL
X = IRRELEVANT

U5/U27-251640-03 SINGLE PORT INTERFACE			
MOS	6529B	3 MHz	

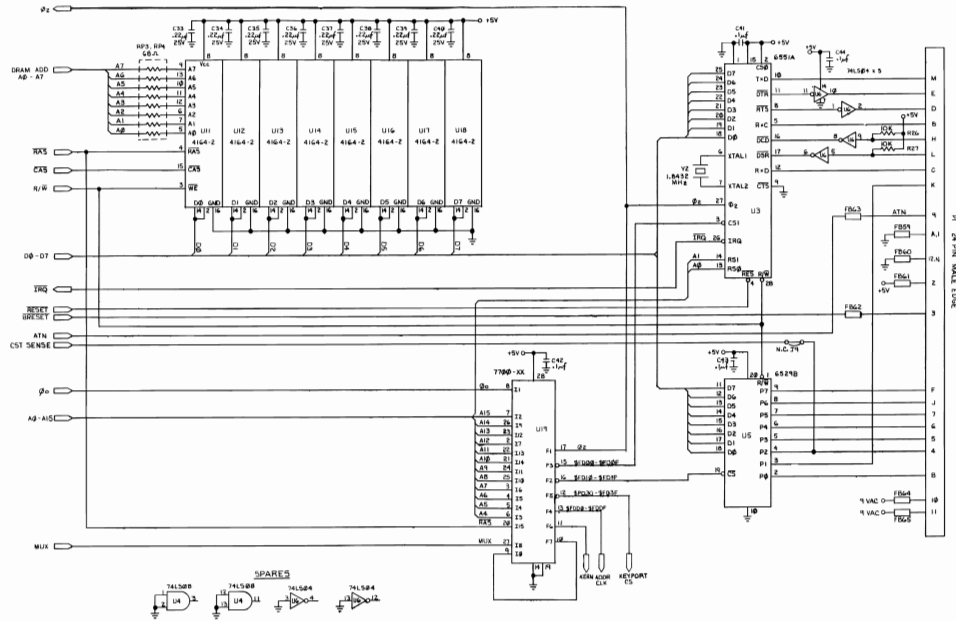


Plus 4 Schematic #310164 (2 of 4)

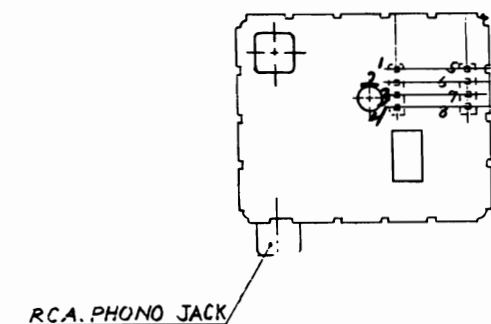
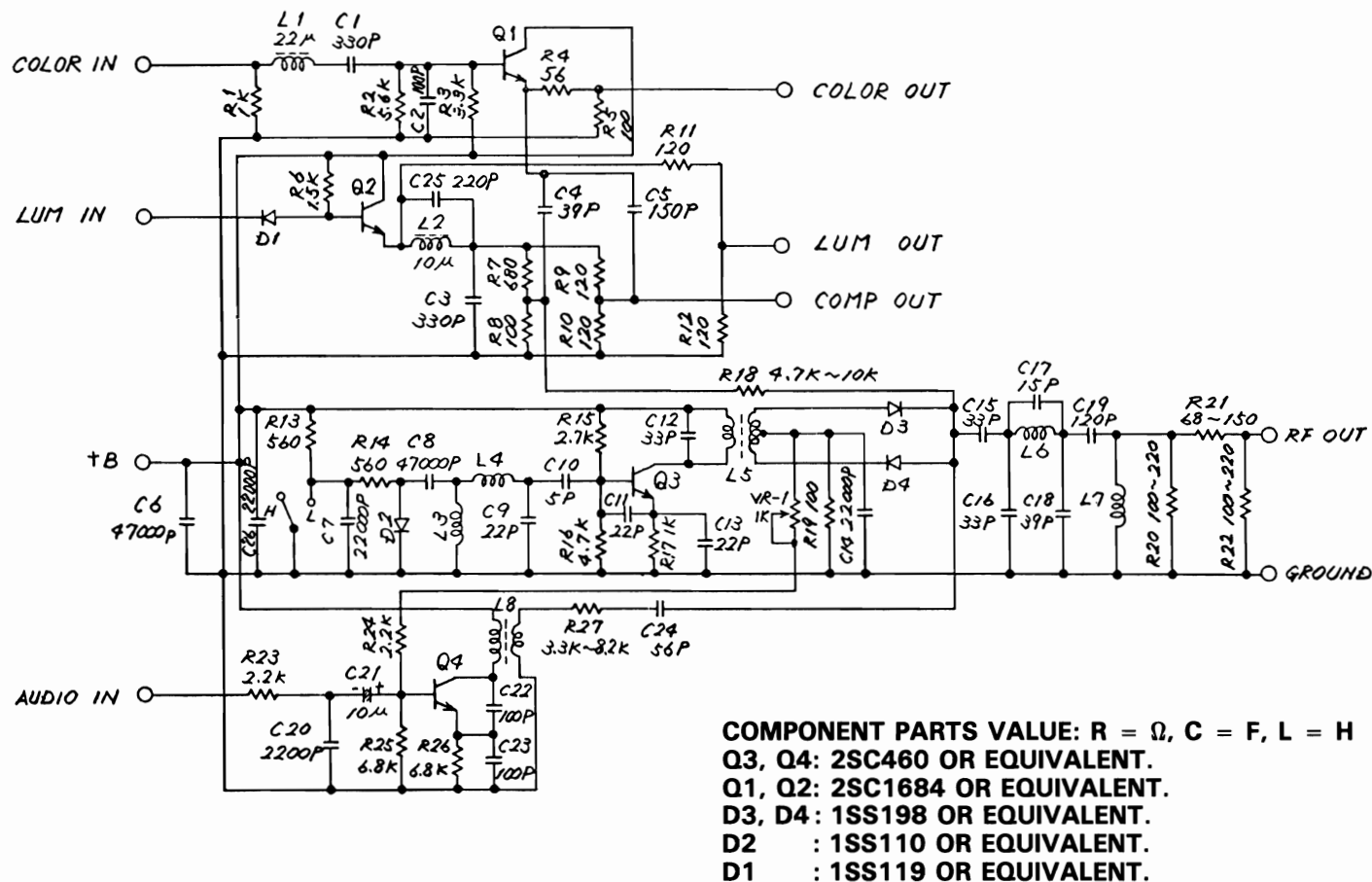
U3, U5, U19 PINOUTS ON PAGE 8



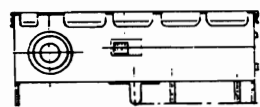
COMMODORE PART NUMBER	APPROVED SOURCE 1 OF SUPPLY	VENDOR PART NUMBER	ACCESS TIME (ns)	CYCLES (ns)	POWER ACTIVE (mW)	STANDBY (MAXIMUM)
901505-01	HITACHI	HM4864-3	200	335	330	20
901505-01	NEC	μPD4164-2	200	375	250	28
901505-01	MITSUBISHI	M5K416NS-20	200	330	275	28
901505-01	MOSTEK	MK4564N-20	200	345	300	22
901505-01	OKI	MSM3764-20	200	330	248	23
901505-01	MICRON TECHNOLOGY	MT4264-3	200	385	300	30
901505-01	HITACHI	HM4864P-3	200	335	330	20
901505-01	MATSUSHITA (PANASONIC)	MN4164P-20	200	330	275	27.5
901505-01	SIEMENS	HYB4164-3	200	330	150	20
901505-01	SHARP	LH2164-Z1	200	330	248	28
901505-01	HITACHI	HM4864AP-3	200	330	242	20
901505-01	TOSHIBA	TM44164AP-20	200	330	275	22



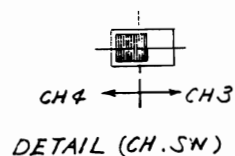
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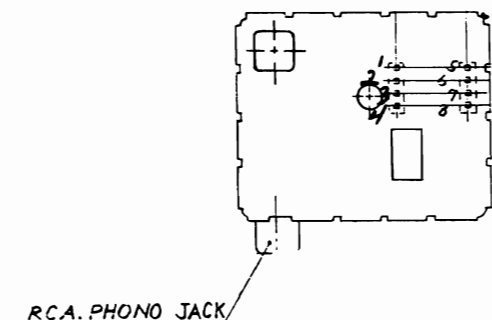
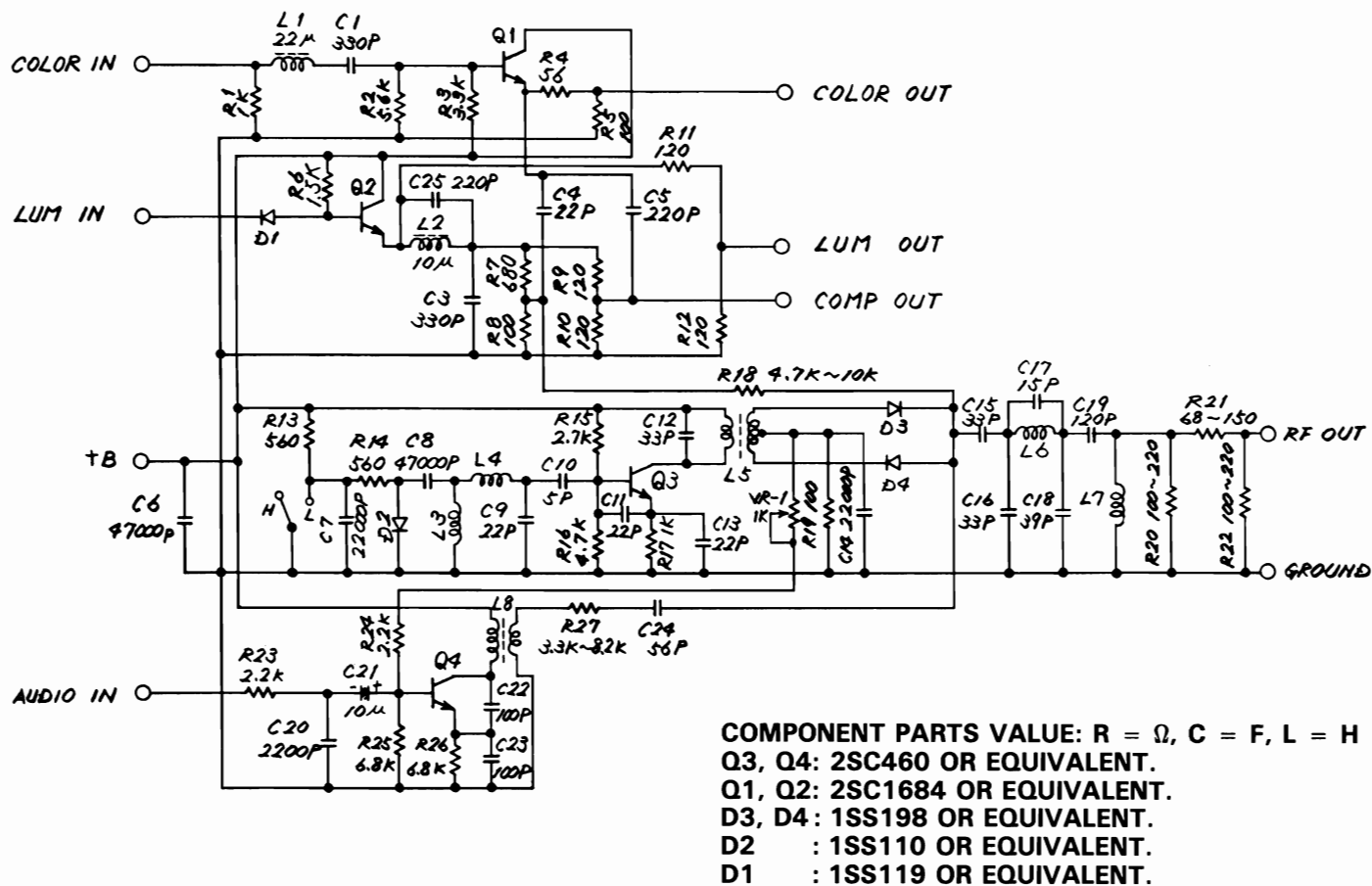
TOP VIEW



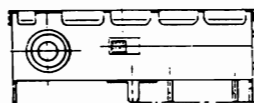
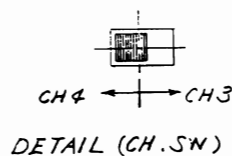
REAR VIEW



NO.	TERMINALS
1	N.C.
2	AUDIO SIG. INPUT
3	+B (+5V)
4	SYNC + LUM. SIG. INPUT
5	COLOR SIG. INPUT
6	COLOR SIG. OUTPUT
7	COMPO. SIG. OUTPUT
8	SYNC + LUM. SIG. OUTPUT
9	RF OUTPUT
10	CHANNEL SELECT SW.



TOP VIEW



REAR VIEW

NO.	TERMINALS
1	N.C.
2	AUDIO SIG. INPUT
3	+B (+5V)
4	SYNC + LUM. SIG. INPUT
5	COLOR SIG. INPUT
6	COLOR SIG. OUTPUT
7	COMPO. SIG. OUTPUT
8	SYNC + LUM. SIG. OUTPUT
9	RF OUTPUT
10	CHANNEL SELECT SW.



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Service Documentation



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